interTwin

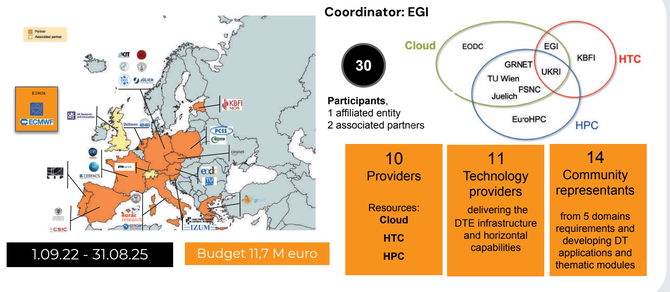
Empowering Science through Digital Twins: The interTwin project

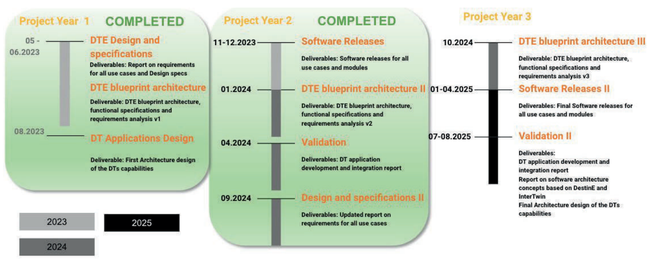
G. Accarino[2], L. Asprea[1], D. Donno[2], D. Elia[2], G. Franck[3], M. Fronza[4], F. Legger[1], A. Manzi[3], F. Sarandrea[1] and S. Vallero[1]

1 INFN, Turin, Italy | 2 CMCC Foundation – Euro-Mediterranean Center on Climate Change, Lecce, Italy | 3 EGI Foundation, Amsterdam, Netherlands | 4 University of Trento, Italy

Project Overview

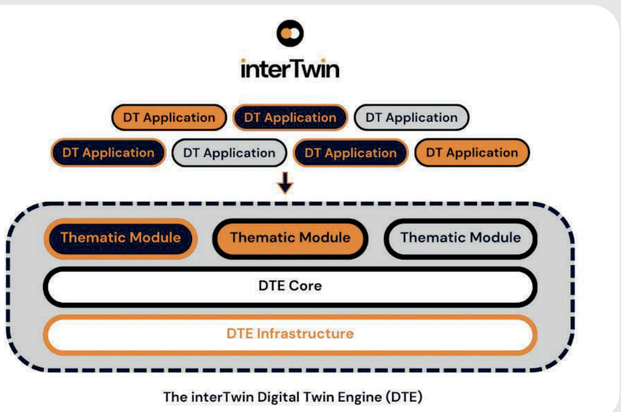
The EU funded interTwin project goal is to co-design and implement the prototype of an interdisciplinary Digital Twin Engine (DTE): an open source platform based on open standards offering the capability to support application-specific Digital Twins (DTs).





The interTwin Digital Twin Engine

interTwin is co-designing its Digital Twin Engine Blueprint architecture and components together with use cases representatives from research communities in various fields.



The interTwin Digital Twin Engine (DTE)

Target users:

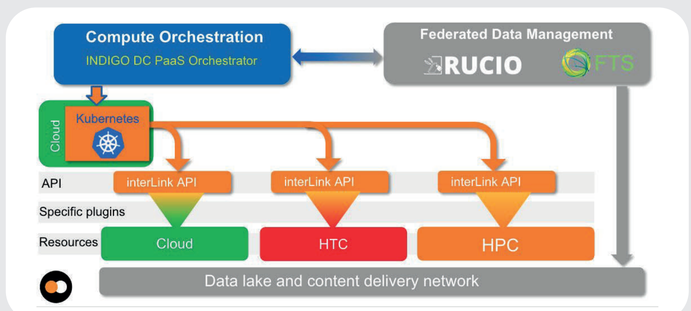
DT Developers: interact with interTwin DTE Core and Infrastructure components, developing DT Applications and thematic modules tailored to the needs of specific user communities

DT Users: access the DTE via the DT Applications developed by the DT developers. An end user can choose an "out of the box" DT Application and connect it to its use case (physical twin) or configure the needed parameters for their experiments

DT Infrastructure Providers: provide computational resources and storage, to build and run the DTs and possibly to enable connectivity with the physical twin

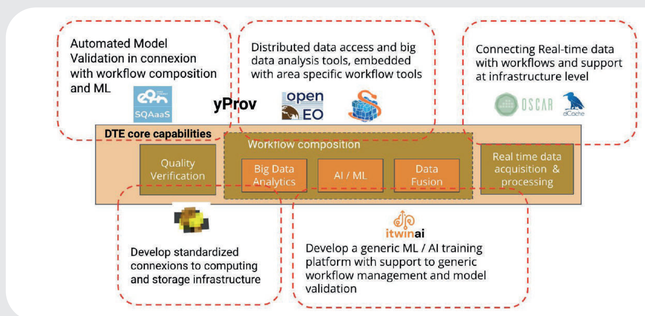
DTE Infrastructure

The interTwin DTE Infrastructure has the role to implement all the capabilities needed by Digital Twins to effectively exploit computing resources. They provide software solutions to: enable resources provisioning on a wide range of compute providers to implement a digital continuum (HPC, HTC, Cloud); support data access and data management in a federated environment; provide services and tools to enable the automated storage and compute resources orchestration.



DTE Core

The interTwin DTE Core enables the development and management of data-driven and compute-intensive applications by providing horizontal capabilities such as workflow composition, data fusion, AI workflow and method lifecycle management, real time data acquisition and validation, verification, and uncertainty tracing for model quality.



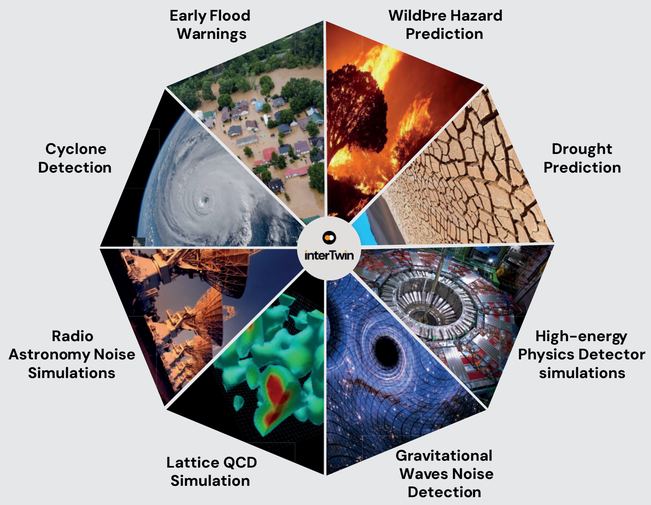
DTE Thematic

Add-ons providing capabilities tailored to the needs of specific application groups. They implement core functionalities for a DT but domain specific. They can evolve into core modules following successful adoption by multiple resource communities across different domains.

Scan the QR code for more information

Use cases

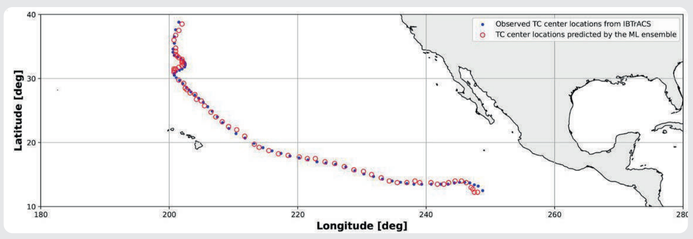
Use cases are developing DT Applications which will benefit from the multi-domain Digital Twin Engine software components and computing infrastructure.



https://www.intertwin.eu/use-cases/

The TC Digital Twin

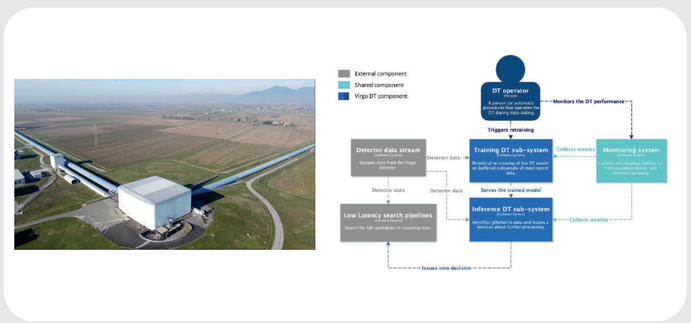
Tropical Cyclones (TCs) are accounted among the most destructive extreme weather events. Traditionally, TCs have been identified in large data sets using deterministic schemes that rely on subjective thresholds. This DT exploits Convolutional Neural Networks (CNNs) and Graph Neural Networks to locate TC centers. An ensemble of CNNs is also being explored to improve the skills of a single ML model [1]. The trained ML models will then be used for inference on CMIP6 experiments to assess the TCs geographical occurrence and frequency.



[1] Accarino, G., et al. (2023). An ensemble machine learning approach for tropical cyclone localization and tracking from ERA5 reanalysis data. Earth and Space Science, 10. https://doi.org/10.1029/2023EA003106

The GlitchFlow Digital Twin

Gravitational interferometers like the LIGO-VIRGO, are important because they allow scientists to detect and study Gravitational Waves (GWs). GWs are ripples in spacetime caused by the acceleration of massive objects, such as black holes or neutron stars. The study of the interferometric data is limited by the presence of transient noise, glitches, which often obscure or hide real signals. GlitchFlow addresses this issue by simulating glitches in the main observational channel of the interferometer using data from auxiliary channels.



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